

What Is Claimed:

1. An apparatus for improving the performance of a catalytic converter to decrease from a first concentration to a second lower concentration at least one exhaust gas pollutant selected from the group consisting of products of incomplete combustion and oxides of nitrogen produced by the combustion of a fuel in an internal combustion engine, comprising:

a combustion chamber;

a post-combustion gas stream;

at least one hydroxyl radical generator adapted and configured to introduce hydroxyl radicals into the post-combustion gas stream;

a power supply adapted and configured to provide high frequency current to the at least one hydroxyl radical

generator; and

at least one catalytic converter, which contains catalytically active material, located in the post-combustion gas stream, wherein at least a portion of the catalytically active material is located downstream from the at least one hydroxyl radical generator,

wherein exhaust gases are formed from the combustion of a fuel in the combustion chamber and at least a portion of the exhaust gases is exposed to the at least one hydroxyl radical generator before being exposed to at least a portion of the catalytic material in the catalytic converter.

2. The apparatus according to claim 1, wherein the generator contains at least one ultraviolet lamp having a wavelength between about 100 nanometers and about 200 nanometers.

3. The apparatus according to claim 1, wherein the generator contains at least one electric discharge device.

4. The apparatus according to claim 1, wherein the power supply provides high frequency current having a frequency of at least about 1,000 Hz.

5 5. The apparatus according to claim 1, wherein the generator is adapted and configured to be powered substantially whenever exhaust gases are produced.

10 6. The apparatus according to claim 1, wherein the internal combustion engine is a diesel engine.

7. The apparatus according to claim 1, wherein the internal combustion engine is a spark-ignition engine.

15 8. The apparatus according to claim 1, wherein the power supply supplies low power.

9. The apparatus according to claim 1, operated in the absence of any reducing agent added to the post-combustion gas stream.

20 10. The apparatus according to claim 3, wherein the at least one electric discharge device, comprises:

at least one first electrode;

at least one second electrode; and

25 at least one dielectric barrier positioned between the first electrode and the second electrode.

11. The apparatus according to claim 1, wherein the generator is separated from the catalytic converter by a pre-determined distance.

30 12. The apparatus according to claim 1, wherein the power supply is adapted and configured such that the voltage

and current may be varied by a controller that monitors engine operating conditions.

13. A method for improving the performance of a catalytic converter to decrease from a first concentration to a second lower concentration at least one exhaust gas pollutant selected from the group consisting of products of incomplete combustion and oxides of nitrogen produced by the combustion of a fuel in an internal combustion engine, comprising:

combusting a fuel and forming exhaust gases in a combustion chamber;

channeling the exhaust gases into a post-combustion gas stream;

exposing at least a portion of the exhaust gases to at least one hydroxyl radical generator located in the post-combustion gas stream;

providing high frequency power to the at least one hydroxyl radical generator; and

passing at least a portion of the exhaust gases that were exposed to the at least one hydroxyl radical generator through at least one catalytic converter, which contains catalytically active material, located in the post-combustion gas stream, wherein at least a portion of the catalytically active material is located downstream from the at least one hydroxyl radical generator.

14. The method according to claim 13, wherein the generator contains at least one electric discharge device.

15. The method according to claim 13, wherein the power supply provides high frequency current having a frequency of at least about 1,000 Hz.

16. The method according to claim 13, wherein the generator is adapted and configured to be powered substantially whenever exhaust gases are produced.

5 17. The method according to claim 13, wherein the power supply supplies low power.

18. The method according to claim 17, wherein the power supply is adapted and configured such that the voltage and current may be varied by a controller that monitors engine
10 operating conditions.

19. The method according to claim 13, performed in the absence of any reducing agent added to the post-combustion gas stream.

15 20. The method according to claim 14, wherein the at least one electric discharge device, comprises:

at least one first electrode;

at least one second electrode; and

20 at least one dielectric barrier positioned between the first electrode and the second electrode.

21. An apparatus for decreasing from a first concentration to a second lower concentration at least one exhaust gas pollutant selected from the group consisting of
25 products of incomplete combustion and oxides of nitrogen produced by the combustion of a fuel in a diesel engine, comprising:

a post-combustion gas stream;

a passageway for channeling at least a portion of the
30 post-combustion gas stream from the engine;

at least one hydroxyl radical generator adapted and configured to introduce hydroxyl radicals into the post-combustion gas stream in the passageway;

5 a power supply adapted and configured to provide current having a frequency of at least about 1,000 Hz. to the at least one hydroxyl radical generator; and

at least one catalytic converter, which contains catalytically active material, located in the passageway, wherein at least a portion of the catalytically active material is located downstream from the at least one hydroxyl
10 radical generator,

wherein at least a portion of the exhaust gases formed from the combustion of fuel in the internal combustion engine is exposed to at least a portion of the at least one hydroxyl radical generator before being exposed to at least a portion
15 of the catalytic converter, wherein the apparatus is adapted and configured to produce hydroxyl radicals substantially whenever the internal combustion engine is producing exhaust gases and the apparatus is adapted and configured such that no additional reducing agent is added to the exhaust gases
20 produced from the combustion of the fuel.

22. The apparatus according to claim 21, wherein the at least one hydroxyl radical generator is an electric discharge device, comprising:

25 at least one first electrode;
at least one second electrode; and
at least one dielectric barrier positioned between the at least one first electrode and the at least one second electrode.

30 23. The apparatus according to claim 21, wherein the generator is separated from the catalytic converter by a pre-determined distance.